Circular Polarization Selection Using an Asymmetric SRR Mirror.

Ismael Barba*, Oscar Fernández, Álvaro Gómez, Ana Grande, Ana C. López-Cabeceira, José Represa
Universidad de Valladolid & Universidad de Cantabria. Spain
corresponding author: ibarba@ee.uva.es

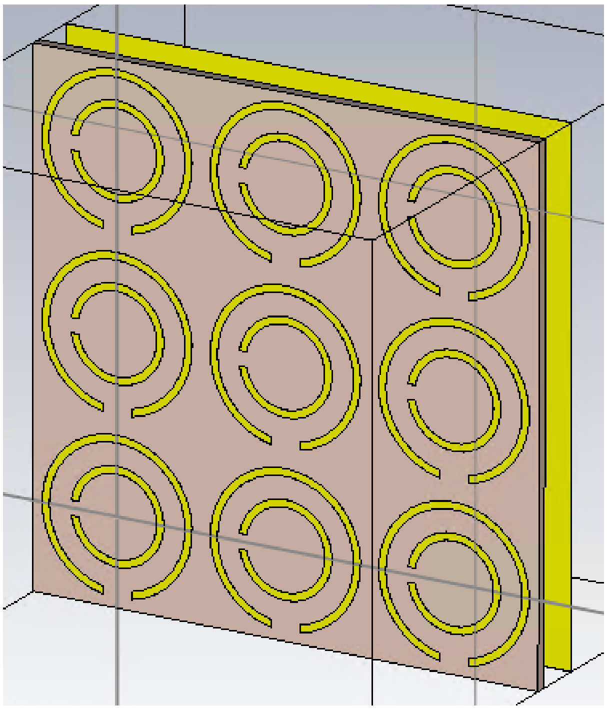

Fig. 1. Proposed structure. Periodical array of copper SRRs on a FR4 substrate. There is a metallic (copper) mirror under the structure.

Reflective surfaces (mirrors) have a wide use in the field of optical or electromagnetic applications, wherever it is needed to redirect electromagnetic radiation. Though mirror technology exists since more than 8,000 years ago, there is not yet a well-established technology for circular polarization control: even more, conventional mirrors reverse the handedness or circularly polarized waves.

Bi-isotropic (chiral) structures have been proposed to manipulate the polarization of travelling waves (optical/electromagnetic activity and circular dichroism). Nevertheless, up to date, all the known examples of such materials are non-reciprocal. This means that a mirror based on a bi-isotropic slab would behave as a conventional mirror: whatever difference performed to the transmitted wave is reverted after the reflection.

Polarization control in a reflector surface may be achieved by combining anisotropy with planar asymmetry (what is known as "2D-chirality") in the same structure. In this work we propose the use of an asymmetric arrangement of the well-known Split Ring Resonator combined with a metallic mirror (Fig. 1).

Its response (reflection coefficient) to normally incident circular polarized waves has been analyzed, the results being shown in Fig. 2.

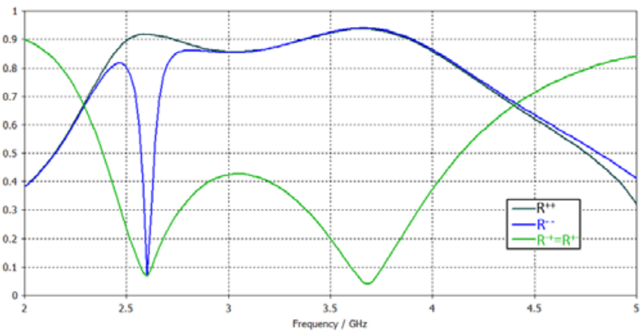

Fig. 2. Reflection coefficient for a circularly polarized wave normally incident on a structure as shown in Fig.1. The superindexes +/- stand for right-handed/left-handed circular polarized waves.

We can see in the figure how, first, there is a wide band (between 2.3 and 4,4 GHz, approximately) where the incident wave is reflected preserving its original circular polarization handedness. Second, there is narrower band around 2.6 GHz where the mirror reflects right-handed circular polarized waves (reflection coefficient around 0.92) while absorbs left-handed circular polarized waves (reflection coefficient around 0.07).